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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|--|-------------|----------------------|-------------------------------|------------------|
| 10/620,003 | 07/14/2003 | Salman Akram | 2269-3521.5US (97-0985.05) | 7478 |
| 24247 | 7590 | 02/19/2004 | EXAMINER | |
| TRASK BRITT P.O. BOX 2550 SALT LAKE CITY, UT 84110 | | | NGUYEN, KHIEM D | |
| | | | ART UNIT | PAPER NUMBER |
| | | | 2823 | |

DATE MAILED: 02/19/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|-------------------------------|------------------------------|--|
| Office Action Summary | Application No. 10/620,003 | Applicant(s) SALMAN AKRAM | |
| | Examiner Khiem D Nguyen | Art Unit 2823 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-9, 11, 13-18 and 21-28 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-9, 11, 13-18 and 21-28 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 July 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>111703</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-9, 11, 13-18, and 21-28 are rejected under 35 U.S.C. 102(b) as being anticipated by Akram et al. (U.S. Patent 5,592,736).

In re claims 1, Akram et al. discloses a method for forming a contact interface, comprising (col. 7, line 11 to col. 8, line 32 and **FIGS. 6-10**): providing a substrate (**FIG. 7: 12**) including semiconductor material with at least one contact comprising semiconductor material protruding (**FIG. 7: 40, 42, 44, and 46**) from the substrate; forming layer comprising dielectric material (**FIG. 7: 64**) (col. 7, lines 11-17) over the semiconductor material and the at least one contact; forming a silicide contact (**FIG. 8B: 78A**) (col. 8, lines 8-19) over the layer comprising dielectric material and over at least a portion of a lateral surface of the at least one contact (**FIGS. 6-8B**).

In re claim 2, Akram et al. discloses wherein forming the layer comprising dielectric material comprises forming silicon dioxide (col. 7, lines 11-17).

In re claim 3, Akram et al. discloses wherein the method of claim 27, further comprising: forming a layer comprising barrier material (**FIG. 8A: 68**) (col. 7, lines 42-50) over the layer comprising polysilicon (**FIG. 8B: 76**) (col. 7, lines 60-65).

In re claim 4, Akram et al. discloses wherein forming the layer comprising barrier material is effected before forming the silicide contact (**FIGS. 8A-B**).

In re claim 5, Akram et al. discloses wherein the method of claim 4, further comprising: exposing at least a portion of the layer comprising polysilicon located over the at least one contact, including at least a portion of the layer comprising polysilicon located over at least the portion of the lateral surface of the at least one contact through at least the layer comprising barrier material (**FIGS. 8A-B**).

In re claim 6, Akram et al. discloses wherein forming the layer comprising barrier material comprises forming a layer comprising at least one of titanium nitride, tungsten nitride, tungsten silicon nitride, and titanium silicon nitride (col. 7, lines 42-50).

In re claim 7, Akram et al. discloses wherein the method of claim 3, further comprising forming another layer comprising dielectric material over the layer comprising polysilicon prior to forming the layer comprising barrier material (**FIGS. 8A-B**).

In re claims 8 and 9, Akram et al. discloses wherein forming the another layer comprising dielectric material comprises depositing silicon dioxide (col. 7, 14-17). The used of TEOS as the dielectric material is well-known to one of ordinary skill in the art of making semiconductor devices.

In re claim 11, Akram et al. discloses wherein forming the layer comprising electrically conductive silicidable material comprises forming a layer comprising cobalt (col. 7, line 66 to col. 8, line 7).

In re claim 13, Akram et al. discloses wherein annealing is effected by heating at least the polysilicon to a temperature of about 650°C to about 820°C (col. 8, lines 8-20).

In re claim 14, Akram et al. discloses wherein annealing is effected by heating at least the polysilicon to a temperature of about 650°C to about 820°C (col. 8, lines 8-20).

In re claim 15, Akram et al. discloses wherein the method of claim 13, further comprising removing an unreacted portion of the electrically conductive silicidable material (col. 8, lines 20-32).

In re claim 16, Akram et al. discloses wherein removing the unreacted portion is effected without substantially removing reacted electrically conductive silicidable material (col. 8, lines 20-32).

In re claim 17, Akram et al. discloses wherein removing the unreacted portion is effected without substantially removing said the barrier material (col. 8, lines 20-32).

In re claim 18, Akram et al. discloses wherein removing the unreacted portion is effected with a hydrochloric/peroxide mixture solution (col. 8, lines 20-42).

In re claim 21, Akram et al. discloses wherein the method of claim 24, further including removing the layer comprising barrier material after forming the silicide contact (**FIGS. 8A-B**).

In re claim 22, Akram et al. discloses wherein removing the layer comprising barrier material is effected without substantially removing the silicide contact (**FIGS. 8A-B**).

In re claim 23, Akram et al. discloses wherein removing the layer comprising barrier material is effected without substantially removing the layer comprising dielectric material (**FIGS. 8A-B**).

In re claim 24, Akram et al. discloses wherein removing the layer comprising barrier material comprises substantially completely removing the barrier material (**FIGS. 8A-B**).

In re claim 25, Akram et al. discloses wherein removing is effected with an ammonia/peroxide mixture solution (col. 8, lines 20-42).

In re claim 26, Akram et al. discloses wherein forming the layer comprising barrier material comprises preventing the electrically conductive silicidable material from reacting with the semiconductor material through at least one of a void and an imperfection in the layer comprising dielectric material (col. 7, lines 11 to col. 8, lines 20 and **FIGS. 7-8B**).

In re claim 27, Akram et al. discloses wherein forming the silicide contact comprises: forming a layer comprising polysilicon (**FIG. 8B: 76**) (col. 7, lines 60-65) over the layer comprising dielectric material (**FIG. 8B: 64**); and forming a layer comprising electrically conductive silicidable material (**FIG. 8B: 78**) over the layer comprising polysilicon; and annealing the polysilicon and the electrically conductive silicidable material (col. 8, lines 8-20).

In re claim 28, Akram et al. discloses wherein the method of claim 3, further comprising removing an unreacted portion of the electrically conductive silicidable material (col. 8, lines 20-32).

Art Unit: 2823


Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khiem D Nguyen whose telephone number is (571) 272-1865. The examiner can normally be reached on Monday-Friday (8:00 AM - 5:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on (571) 272-1855. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 305-3432 for regular communications and (703) 305-3432 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

K.N.
February 11, 2004



W. DAVID COLEMAN
PRIMARY EXAMINER